

Accuracy Characteristics for ZDC Risk Reduction Scenario Hours 2030-2230

1 Introduction

This document contains scenario characteristics for hours 2030 to 2230 GMT recorded on October 11, 2000 at Washington ARTCC (ZDC). Characteristics to be provided are general statistics determined from the scenario on airspace characteristics, aircraft to aircraft and aircraft to airspace encounters, general air traffic, aircraft, and flight plan adherence. Definitions of the provided scenario characteristics are provided in Reference[1].

2 Reference

[1] Paglione,M., Oaks,R., Ryan,Dr. H., Summerill,J.S., (Final, January 2000), *Description of Accuracy Scenarios for the Acceptance Testing of the User Request Evaluation Tool (URET) / Core Capability Limited Deployment (CCLD)*, FAA William J. Hughes Technical Center / ACT-250, Atlantic City, New Jersey.

NOTE – Section numbers in this document do not map to those of the reference document.

3 Center Airspace

This section corresponds to Section 3.1 of Reference[1]. The below data corresponds to the ZDC Center using the October 11, 2000 ACES chart cycle. Information provided in Table 1 was gathered from running URET PRE and local knowledge.

Table 1: Center Airspace Characteristics

Metric	Definitions	Count
Airports	From URET DU Adaptation List	TBD
Sectors	From URET DU Adaptation List	TBD
SAA	Special Activities Airspace	TBD
APDIA	Automated Problem Detection Inhibited Area	TBD
SID	Standard Instrument Departure	TBD
STAR	Standard Arrival Route	TBD
PAR	Preferential Arrival Route	TBD
PDR	Preferential Departure Route	TBD
PDAR	Preferential Departure Arrival Route	TBD

4 Aircraft Encounter Distributions

The statistics collected in this section characterize aircraft to aircraft encounters. The encounter counts are partitioned by selected minimum horizontal separation intervals, a count of encounters partitioned by standard flight levels, and by vertical phase of flight and aircraft encounter angle. This section corresponds to Section 3.2.1 in Reference[1].

4.1 Count Partitioned by Minimum Horizontal Separation

This section corresponds to Section 3.2.1.1 in Reference[1].

Table 2: Count of Current Plan Aircraft Encounters

Min. Horz. Separation (nm)	Without Adherence	13 Minutes Adherence
$0 \leq d < 5$	108	47
$5 \leq d < 10$	167	75
$10 \leq d < 15$	269	89
$15 \leq d < 23$	522	206
$23 \leq d < 30$	515	198
Total	1581	615

Table 3: Count of Trial Plan Aircraft Encounters

Min. Horz. Separation (nm)	Without Adherence	20 minutes Adherence
$0 \leq d < 5$	108	44
$5 \leq d < 10$	167	67
$10 \leq d < 15$	269	81
$15 \leq d < 24$	619	220
$24 \leq d < 30$	418	150
Total	1581	562

4.2 Count Partitioned by Altitude for Standard Separation Intervals

This section corresponds to Section 3.2.1.2 of Reference[1].

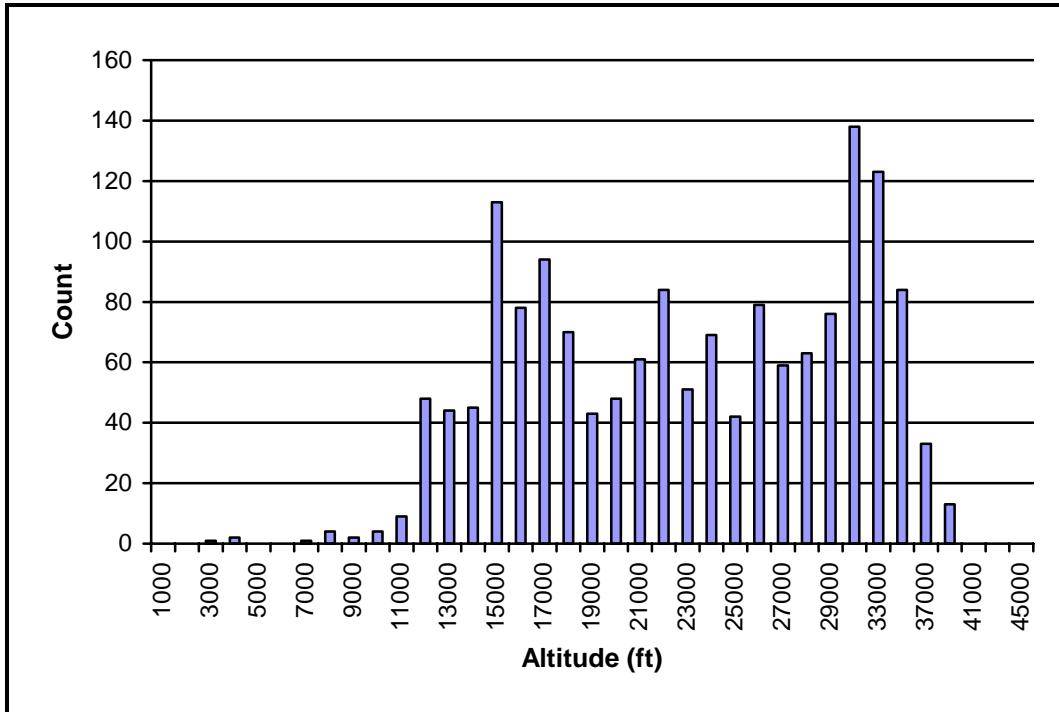


Figure 1: Aircraft to Aircraft Encounters by Altitude

4.3 Count Partitioned by Vertical Phase of Flight and Encounter Angle

This section corresponds to Section 3.2.1.3 of Reference[1].

Table 4: Count of Aircraft Encounters Partitioned by Phase of Flight and Encounter Angle

Vertical Phase	Encounter Angles (deg)				Total
	[0, 45)	[45, 90)	[90, 135)	[135, 180]	
Cruise-Cruise	43	6	6	20	75
Descend-Descend	107	9	8	8	132
Climb-Climb	151	14	14	22	201
Cruise-Climb	256	57	76	102	491
Cruise-Descend	172	50	41	142	405
Climb-Descend	94	21	21	126	262
Unknown	12	1	0	2	15
Total	835	158	166	422	1581

5 Airspace Encounter Distributions

This section provides statistics on aircraft to airspace encounters. Three areas considered are counts partitioned by selected minimum horizontal separation intervals, an encounter count partitioned by standard flight levels, and a count partitioned by vertical phase of flight and airspace encounter angle. Additionally, vertical phase of flight count is separated into top, bottom and side airspace encounters and for encounters with unknown encounter angles. The section corresponds to Section 3.2.2 of Reference[1].

5.1 Count Partitioned by Minimum Horizontal Separation

The section corresponds to Section 3.2.2.1 of Reference[1].

Table 5: Count of Current Plan Airspace Encounters by Horizontal Separation

Min. Horz. Separation (nm)	Without Adherence	13 minutes Adherence
Conflicts ¹	117	83
$d = 0^2$	62	55
$0 < d < 7$	486	336
$7 \leq d < 9$	145	89
$9 \leq d < 11$	184	125
$11 \leq d < 16$	389	269
$16 \leq d < 30$	1266	894
Total	2649	1851

Table 6: Count of Trial Plan Airspace Encounters by Horizontal Separation

Min. Horz. Separation (nm)	Without Adherence	20 minutes Adherence
Conflicts ³	117	79
$d = 0^4$	62	51
$0 < d < 8$	543	363
$8 \leq d < 11$	272	177
$11 \leq d < 13$	165	99
$13 \leq d < 19$	510	361
$19 \leq d < 30$	980	646
Total	2649	1776

¹ This count includes encounters that are conflicts. By definition the minimum horizontal separation is zero and the track point actually penetrates the airspace.

² This count includes encounters without valid airspace penetrations, which occurs under two cases: a short duration penetration or an encounter on the actual buffered boundary of the airspace which does not penetrate.

³ This count includes encounters that are conflicts. By definition the minimum horizontal separation is zero and the track point actually penetrates the airspace.

⁴ This count includes encounters without valid airspace penetrations, which occurs under two cases: a short duration penetration or an encounter on the actual buffered boundary of the airspace which does not penetrate.

5.2 Count Partitioned by Altitude

This section corresponds to Section 3.2.2.2 of Reference[1].

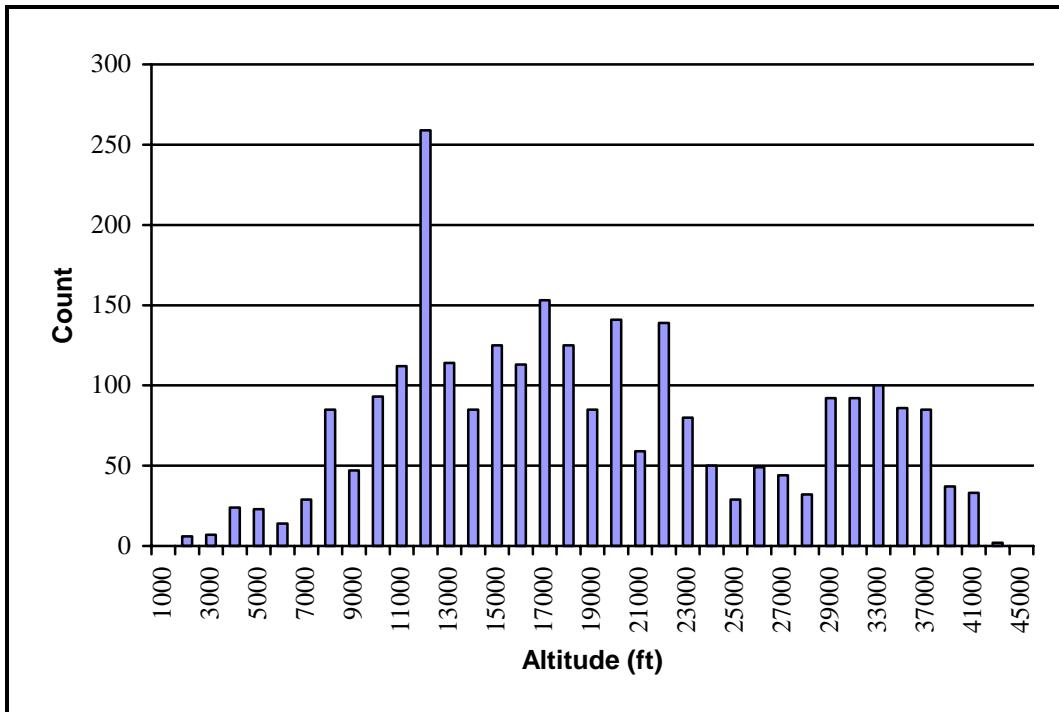


Figure 2: Airspace to Airspace Encounters by Altitude

5.3 Count by Vertical Phase of Flight and Encounter Angle

This section corresponds to Section 3.2.2.3 in Reference[1].

Table 7: Count of Airspace Encounters by Angle and Vertical Phase of Flight for Side Conflicts

Vertical Phase	Encounter Angles (deg)			Total
	[0, 30)	[30, 60)	[60, 90)	
Climb	4	5	3	12
Cruise	36	20	16	72
Descend	3	4	3	10
Total	43	29	22	94

Table 8: Count of Airspace Encounters by Angle and Vertical Phase of Flight for Top and Bottom Conflicts

Vertical Phase	Encounter Angles (deg)			Total
	[0, 30)	[30, 60)	[60, 90)	
Climb	3	0	0	3
Cruise	0	0	0	0
Descend	6	0	0	6
Total	9	0	0	9

Table 9: Count of Airspace Encounters by Vertical Phase of Flight with Unknown Angles

Vertical Phase	Count
Climb	7
Cruise	5
Descend	2
Total	14

6 Air Traffic Distributions

This section provides metrics that characterize the air traffic. The metrics are flight density partitioned by standard flight levels, flight type and sector penetration, statistics on the number of active flights, ground speed statistics, counts of interim altitude and amendment messages, and air traffic maneuvers by altitude and phase of flight. This section corresponds to Section 3.3 of Reference[1].

6.1 Air Traffic Density

This section corresponds to section 3.3.1 of Reference[1]. Detailed statistics on aircraft encounters are provided in Appendix A.

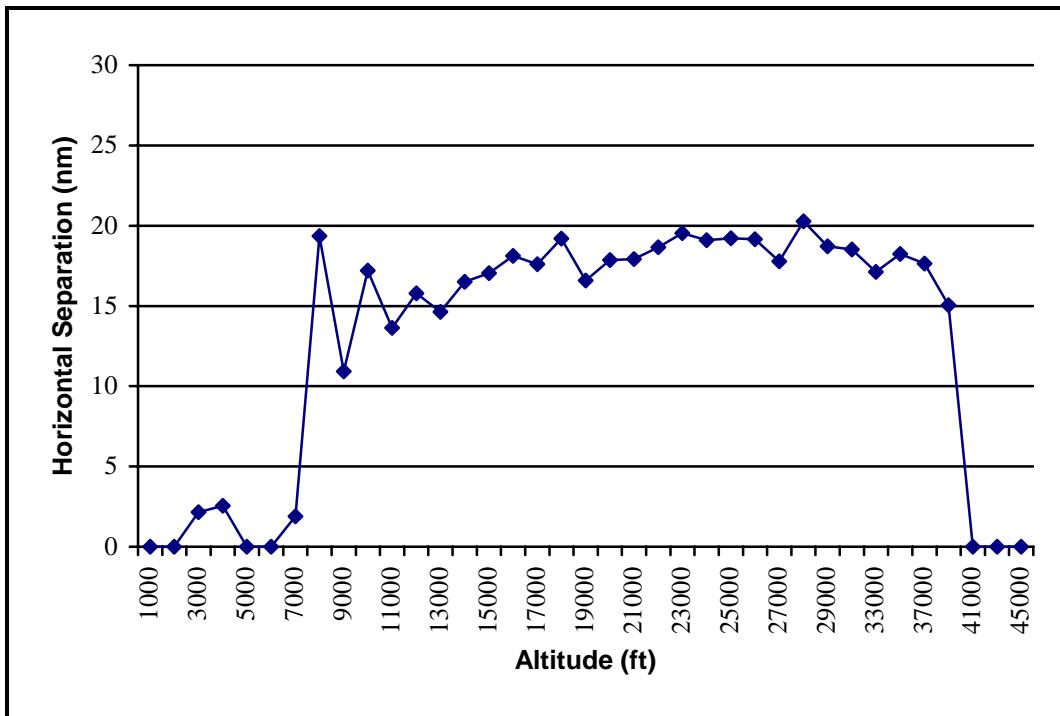


Figure 3: Average Horizontal Separation by Altitude for All Hours

6.2 Active Flights

This section corresponds to section 3.3.2 of Reference[1].

Table 10: Statistics on Active Flights per Minute Increment

Count Average	Standard Deviation	Maximum Count	Minimum Count
130.825	151.847	364	0

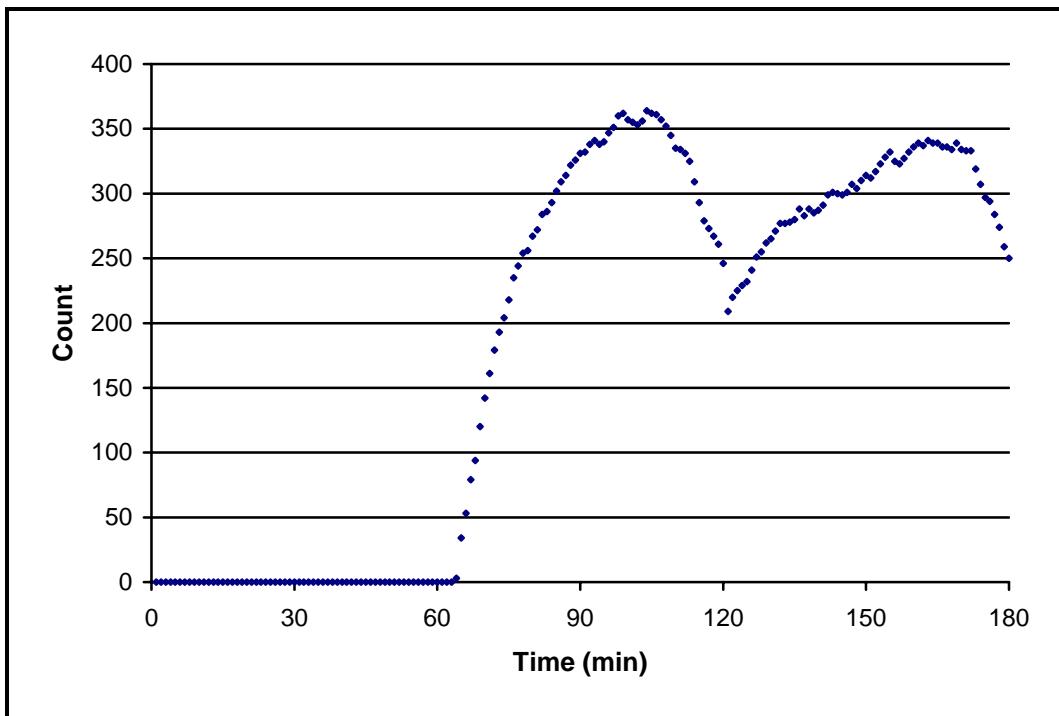


Figure 4: Count of Active Flights per Minute Increment

6.3 Flight Type and Sector Penetration

This section corresponds to Section 3.3.3 of Reference[1].

Table 11: Statistics on Sector Time, Center Time and Sector Penetration by Flight Type

Metric	Arrivals	Departures	Internals	Overflights	All Flights
Average Number of Sectors Penetrated	2.194	2.166	2.219	2.467	2.216
Average Time in Center (sec)	1200.620	1115.890	1109.683	1372.222	1145.666
Average Time in Sector (sec)	538.551	509.773	488.541	550.360	507.941
Percentage by Flight Type	19.755	24.962	48.239	6.891	100.000

6.4 Ground Speed

This section corresponds to Section 3.3.4 of Reference[1]. Detailed statistics on aircraft ground speed are provided in Appendix B.

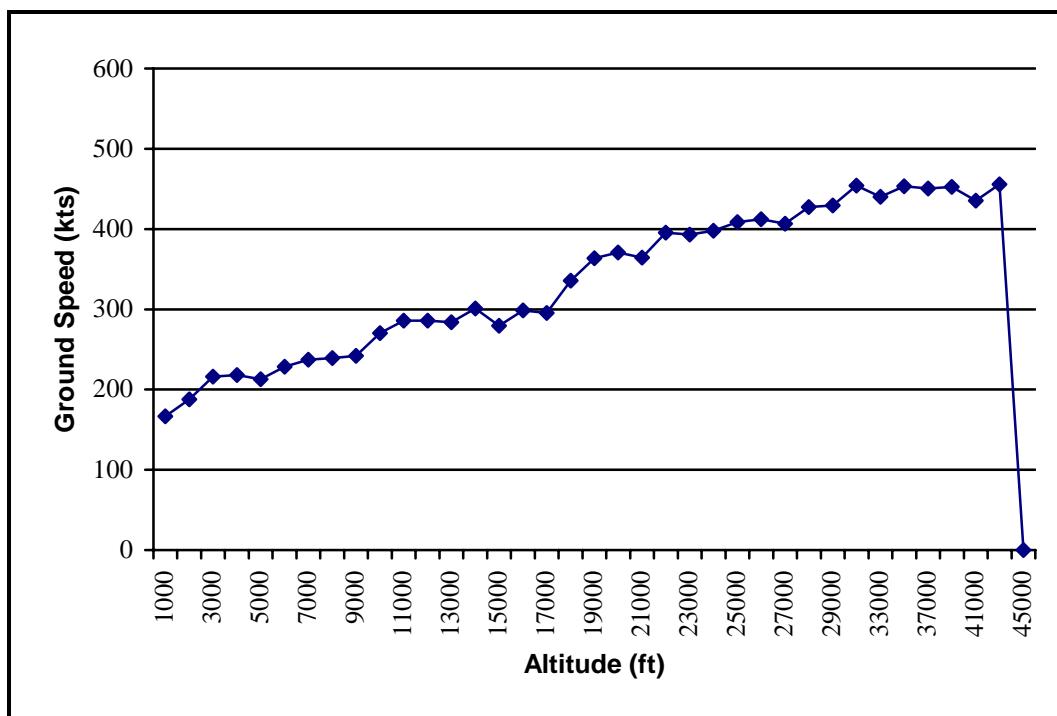


Figure 5: Average Ground Speed by Altitude for All Hours

6.5 Center to APD Ratio

This section corresponds to Section 3.3.5 of Reference[1].

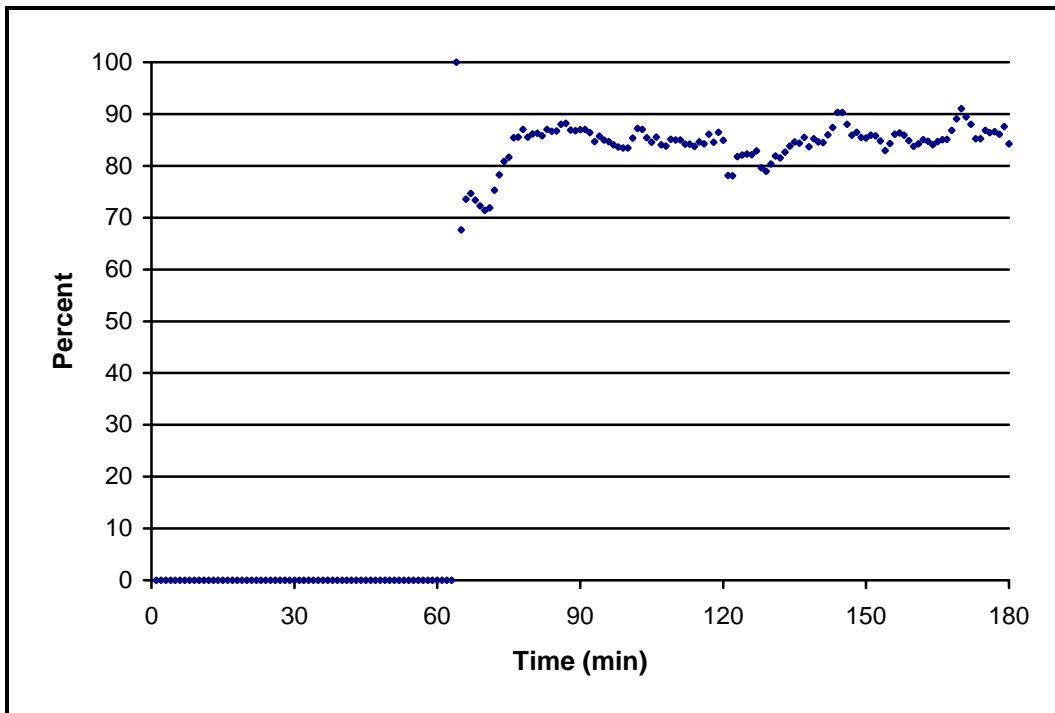


Figure 6: Percentage of Track Points in Center to APD Zone per Minute Increment

6.6 Interim Altitude Messages

This section corresponds to Section 3.3.6 of Reference[1].

Table 12: Statistics on Interim Altitude Messages⁵

Flight Count	Average	Standard Deviation	Maximum Count	Minimum Count
336	2.560	0.855	5	1

6.7 Amendment Messages

This section corresponds to Section 3.3.7 of Reference[1]

Table 13: Statistics on Amendment Messages per Flight⁶

Flight Count	Average	Standard Deviation	Maximum Count	Minimum Count
469	2.821	1.741	11	1

⁵ Statistics on flights with interim altitude messages only

⁶ Statistics on flights with flight plan amendments only

6.8 Air Traffic Maneuvers

This section corresponds to Section 3.3.8 of Reference[1]. Detailed statistics on air traffic maneuvers are provided in Appendix C.

Table 14: Total Track Report Maneuver Count by Vertical and Horizontal Phase of Flight

Vertical Phase	Horizontal Phase of Flight		Total
	STR	TURN	
ASC	5102	1539	6641
DES	4102	726	4828
LEV	1470	776	2246
Total	10674	3041	13715

Table 15: Percent breakdown of Flight Tracks by Vertical and Horizontal Phase

Vertical Phase	Horizontal Phase of Flight		Margin (%)
	STR (%)	TURN (%)	
ASC	37.200	11.221	48.421
DES	29.909	5.293	35.202
LEV	10.718	5.658	16.376
Margin (%)	77.827	22.173	100.000

7 Aircraft Distributions

This sections provides the metrics used to characterize the aircraft provided in the scenario. The selected metrics are aircraft type, model, navigational equipment, and the air carriers operating in the airspace. The section corresponds to Section 3.4 of Reference[1].

7.1 Aircraft Type

This section corresponds to Section 3.4.1 of Reference[1].

Table 16: Count by Aircraft Type

Aircraft Type	Count	Percentage of Total
J	505	75.373
P	16	2.388
T	142	21.194
Unknown	7	1.045
Total	670	100.000

7.2 Aircraft Models

This section corresponds to Section 3.4.2 of Reference[1]. A full listing and count of aircraft models is provided in Appendix D.

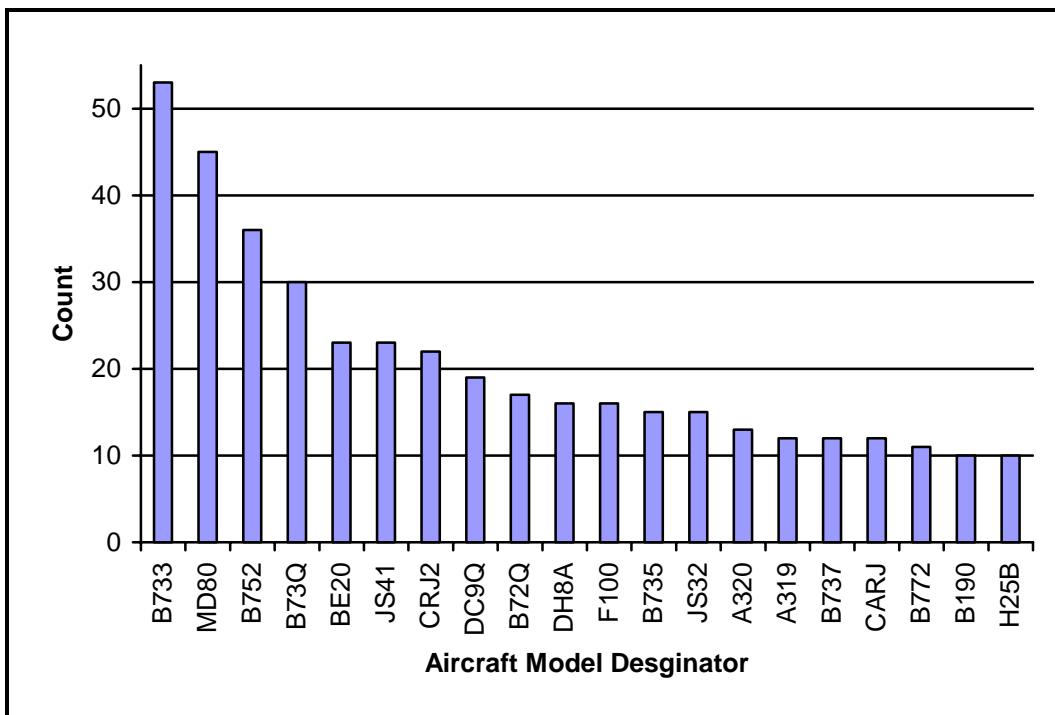


Figure 7: Count of Top Twenty Aircraft Models

7.3 Navigational Equipage

This section corresponds to Section 3.4.3 of Reference[1].

Table 17: Count by Aircraft Navigational Equipage Type

Nav. Equip. Designator	Count	Percentage of total
A	139	20.746
F	132	19.701
I	119	17.761
E	116	17.313
G	102	15.224
R	37	5.522
Q	19	2.836
W	4	0.597
Unknown	2	0.299
Total	670	100.000

7.4 Carrier Distribution

This section corresponds to Section 3.4.4 of Reference[1].

Table 18: Count by Carrier Type

Category	Count	Percentage of Total
Commercial	510	76.119
General Aviation	118	17.612
Other ⁷	42	6.269
Total	670	100.000

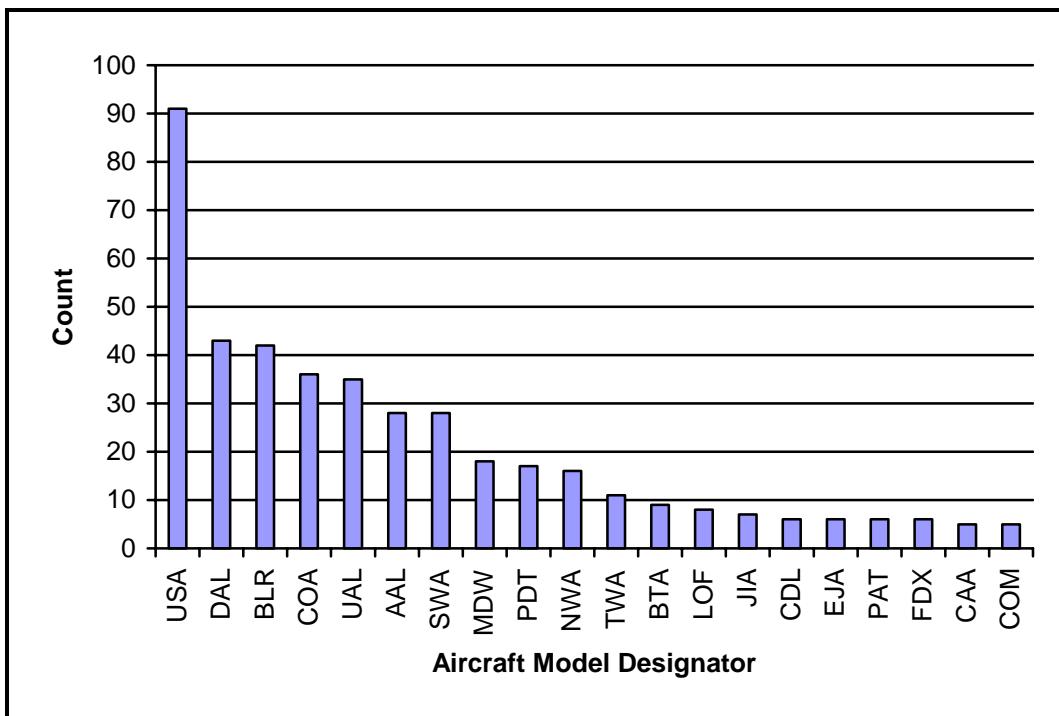


Figure 8: Count by Top Twenty Air Carriers

⁷ Includes military and aircraft with unrecognized designators

8 Flight Plan Adherence

This section provides statistics on lateral and vertical flight plan adherence and corresponds to Section 3.5 of Reference[1].

8.1 Lateral Flight Plan Adherence

This section corresponds to Section 3.5.1 of Reference[1].

Table 19: Statistics on Lateral Flight Plan Adherence by Altitude⁸

Upper Altitude (ft)	Flight Count	Max. Dist. Out (nm)	Min. Dist. Out (nm)	Average Dist. Out (nm)	Standard Dev.(nm)
10000	32	386.115	11.023	43.384	90.589
18000	28	375.152	13.015	94.820	137.322
33000	48	334.794	13.218	52.049	68.695
45000	25	248.233	19.031	57.089	62.179
Total	133				

8.2 Vertical Flight Plan Adherence

This section corresponds to Section 3.5.2 of Reference[1].

Table 20: Statistics on Vertical Flight Plan Adherence by Altitude⁹

Upper Altitude (ft)	Flight Count	Max. Dist. Out (ft)	Min. Dist. Out (ft)	Average Dist. Out (ft)	Standard Dev.(ft)
29000	316	17900	309	4632.527	2792.267
45000	87	19000	600	6697.015	3884.783
Total	403				

⁸ Statistics determined on tracks out of lateral adherence only.

⁹ Statistics were determined on tracks out of vertical adherence only.

Appendix A: Supplement to Section 6.1 - Aircraft Traffic Density

Table 21: Statistics on Aircraft Encounters by Altitude Interval for All Hours

Upper Altitude (ft)	Aircraft Count	Avg. Horz. Sep.(nm)	Standard Dev.(nm)
1000	0	0.000	0.000
2000	0	0.000	0.000
3000	1	2.150	0.000
4000	2	2.558	1.764
5000	0	0.000	0.000
6000	0	0.000	0.000
7000	1	1.889	0.000
8000	4	19.364	4.994
9000	2	10.932	12.015
10000	4	17.212	10.506
11000	9	13.627	7.595
12000	48	15.796	7.808
13000	44	14.630	7.635
14000	45	16.496	8.294
15000	113	17.039	7.885
16000	78	18.113	7.640
17000	94	17.601	7.475
18000	70	19.193	7.689
19000	43	16.576	6.919
20000	48	17.859	7.482
21000	61	17.915	7.418
22000	84	18.665	8.081
23000	51	19.527	7.513
24000	69	19.094	6.239
25000	42	19.212	6.497
26000	79	19.166	7.001
27000	59	17.788	8.061
28000	63	20.281	6.521
29000	76	18.711	7.682
31000	138	18.510	7.522
33000	123	17.115	7.665
35000	84	18.242	7.420
37000	33	17.634	8.351
39000	13	15.041	6.464
41000	0	0.000	0.000
43000	0	0.000	0.000
45000	0	0.000	0.000
Total	1581		

Appendix B: Supplement to Section 6.4 - Aircraft Ground Speed

Table 22: Statistics on Ground Speed by Altitude for All Hours

Upper Altitude (ft)	Distinct Aircraft	Average Speed (kts)	Standard Dev.(kts)
1000	5	166.480	23.231
2000	28	187.757	36.623
3000	66	216.077	45.680
4000	122	218.172	52.780
5000	168	212.858	51.610
6000	221	228.607	51.492
7000	261	237.280	43.385
8000	295	239.318	44.281
9000	328	242.066	48.101
10000	351	270.209	53.886
11000	395	285.945	61.807
12000	428	285.728	65.250
13000	431	283.661	65.845
14000	422	300.927	72.413
15000	420	279.562	70.653
16000	403	298.735	69.298
17000	386	295.564	72.239
18000	368	335.719	67.435
19000	358	363.606	66.081
20000	352	370.629	68.309
21000	342	364.434	70.614
22000	333	395.467	77.476
23000	319	393.097	66.439
24000	310	397.955	53.654
25000	303	408.684	51.119
26000	291	412.139	67.220
27000	285	406.643	66.781
28000	271	427.372	57.904
29000	251	429.425	38.628
31000	232	453.944	29.574
33000	192	440.271	23.974
35000	127	453.119	24.109
37000	71	450.488	22.244
39000	37	452.306	21.898
41000	24	435.192	31.186
43000	8	455.551	19.836
45000	0	0.000	0.000

Appendix C: Supplement to Section 6.8 - Air Traffic Maneuvers

Table 23: Count of Maneuvers by Altitude, Vertical and Horizontal Phase of Flight

Upper Altitude (ft)	Vertical Phase	Horizontal Phase of Flight	
		STR	TURN
1000	ASC	1	1
	DES	1	1
	LEV	3	3
2000	ASC	7	6
	DES	6	3
	LEV	13	14
3000	ASC	10	9
	DES	25	23
	LEV	24	28
4000	ASC	16	14
	DES	61	47
	LEV	43	32
5000	ASC	22	13
	DES	76	71
	LEV	56	28
6000	ASC	39	36
	DES	89	87
	LEV	90	42
7000	ASC	28	17
	DES	122	74
	LEV	116	39
8000	ASC	32	26
	DES	138	86
	LEV	128	39
9000	ASC	40	21
	DES	169	89
	LEV	138	42
10000	ASC	36	14
	DES	188	84
	LEV	148	42
11000	ASC	67	33
	DES	228	93
	LEV	176	53
12000	ASC	54	25
	DES	239	109
	LEV	192	28

13000	ASC	34	21
	DES	237	91
	LEV	191	30
14000	ASC	36	22
	DES	247	68
	LEV	191	24
15000	ASC	65	25
	DES	252	62
	LEV	195	25
16000	ASC	57	27
	DES	225	65
	LEV	181	14
17000	ASC	50	26
	DES	227	57
	LEV	178	14
18000	ASC	33	12
	DES	216	52
	LEV	167	20
19000	ASC	26	4
	DES	205	48
	LEV	160	13
20000	ASC	23	12
	DES	209	46
	LEV	161	13
21000	ASC	45	17
	DES	208	32
	LEV	149	15
22000	ASC	48	19
	DES	198	29
	LEV	155	14
23000	ASC	40	15
	DES	189	23
	LEV	144	17
24000	ASC	45	19
	DES	186	25
	LEV	140	19
25000	ASC	54	15
	DES	178	24
	LEV	137	18
26000	ASC	48	20
	DES	173	27

	LEV	136	15
27000	ASC	52	29
	DES	167	23
	LEV	134	17
28000	ASC	58	27
	DES	152	19
	LEV	130	6
29000	ASC	69	33
	DES	135	16
	LEV	123	10
31000	ASC	82	52
	DES	126	19
	LEV	108	24
33000	ASC	80	48
	DES	93	20
	LEV	98	15
35000	ASC	80	53
	DES	74	10
	LEV	47	6
37000	ASC	43	32
	DES	27	5
	LEV	32	6
39000	ASC	27	18
	DES	21	8
	LEV	11	0
41000	ASC	16	10
	DES	9	1
	LEV	6	1
43000	ASC	7	5
	DES	6	2
	LEV	1	0
45000	ASC	0	0
	DES	0	0
	LEV	0	0

Appendix D: Supplement to Section 7.2 - Aircraft Models

Table 24: Count and Percentage of Aircraft by Model Type

Model Type	Aircraft Count	Percent of Total
B733	53	7.910
MD80	45	6.716
B752	36	5.373
B73Q	30	4.478
BE20	23	3.433
JS41	23	3.433
CRJ2	22	3.284
DC9Q	19	2.836
B72Q	17	2.537
DH8A	16	2.388
F100	16	2.388
B735	15	2.239
JS32	15	2.239
A320	13	1.940
A319	12	1.791
B737	12	1.791
CARJ	12	1.791
B772	11	1.642
B190	10	1.493
H25B	10	1.493
B734	9	1.343
A306	8	1.194
B738	8	1.194
BE9L	8	1.194
F15	8	1.194
LJ35	8	1.194
SF34	8	1.194
B763	7	1.045
BE40	7	1.045
C560	7	1.045
D328	7	1.045
E145	7	1.045
C550	6	0.896
CRJ1	6	0.896
DC9	6	0.896
B722	5	0.746
C130	5	0.746

CL60	5	0.746
E135	5	0.746
F16	5	0.746
GLF4	5	0.746
BE58	4	0.597
DH8B	4	0.597
F2TH	4	0.597
GLF3	4	0.597
LJ60	4	0.597
A330	3	0.448
ASTR	3	0.448
B350	3	0.448
BE10	3	0.448
DC10	3	0.448
GLF2	3	0.448
LJ31	3	0.448
LJ55	3	0.448
PA32	3	0.448
SBR1	3	0.448
WW24	3	0.448
A340	2	0.299
AT43	2	0.299
B712	2	0.299
B762	2	0.299
C17	2	0.299
C650	2	0.299
C750	2	0.299
E120	2	0.299
FA50	2	0.299
LJ25	2	0.299
M20P	2	0.299
MD11	2	0.299
PA31	2	0.299
PAY1	2	0.299
PAY2	2	0.299
SW4	2	0.299
A310	1	0.149
B732	1	0.149
B742	1	0.149
B757	1	0.149
B767	1	0.149
BE30	1	0.149

BE35	1	0.149
BE3B	1	0.149
BE9T	1	0.149
C141	1	0.149
C208	1	0.149
C310	1	0.149
C421	1	0.149
C5	1	0.149
C525	1	0.149
C9	1	0.149
CL64	1	0.149
DH8C	1	0.149
E6	1	0.149
F28	1	0.149
FA10	1	0.149
FA20	1	0.149
G2	1	0.149
GLFQ	1	0.149
HS25	1	0.149
MD90	1	0.149
MU30	1	0.149
P3	1	0.149
PA34	1	0.149
PA38	1	0.149
PASE	1	0.149
STAR	1	0.149
SW3	1	0.149
T70	1	0.149
n/a	1	0.149
Total	670	100.000